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**Effects of demographic
development, labour supply and
pension reforms on the future
pension burden**

Abstract:

A much higher old-age dependency ratio together with more generous pension benefits will lead to a substantial increase in the future pension burden in Norway. The challenges of financing the increasing pension expenditures depend on the development in demographic characteristics like fertility, mortality and immigration, as well as characteristics affecting supply of labour, like education, disability, retirement age, participation rates and part time work (especially for women), and the design of the pension system. By use of a dynamic micro simulation model the paper analyses and projects how these factors will affect the expenditures and financing of the Norwegian National Insurance Scheme. The model also allows analyses of distributional effects of pension reforms.

Keywords: Social security, pension expenditures, demographic forecasts, retirement

JEL classification: H53, H55, J11, J14, J26

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1. Introduction

Like most OECD countries Norway will face an ageing population in the next decades. The growth in supply of labour is slowing down, and the old-age dependency ratio is expected to be significantly higher. Together with more generous pension benefits as a consequence of the present Norwegian social security system, this will lead to a substantial increase in the future pension burden. A growing need for health care and social services also means a higher demand for labour in these sectors and a further increase in public expenditures.

Awareness of these problems and a discussion of how they should be met have been present in most countries in the last 15 to 20 years. Comprehensive studies discussing the situation in several countries may be found in reports from OECD (1996 and 1998), the EU Commission (2001) and Kotlikoff and Leibfritz (1999). Among others, Disney (2000) has discussed how to meet the crises in pension programmes in the OECD countries. In the US Feldstein (1996 and 1998) has advocated funding of public pensions, and America's demographic dilemma is analysed in Kotlikoff, Smetters and Walliser (2001) and by Diamond (2004). In a survey Lindbeck and Persson (2003) have discussed some main principles for pension reforms regarding the effects on efficiency, distribution and stability. In Norway the challenges with the increasing pension burden are discussed in several white papers from the Government, c.f. the Long Term Programme for 2002-2005 (St. meld. nr. 30, 2000-2001) and the National Budget for 2004 (St. meld. nr. 1, 2003-2004). According to these white papers, the expenditures for old age and disability benefits in the National Insurance Scheme are estimated to increase from about 9 per cent of GDP in 2002 to about 20 per cent in 2050. Possible reforms aiming to reduce the future pension expenditures are also discussed in NOU 1998:10, NOU 1998:19 and in the report from the recent Norwegian Pension Commission, NOU 2004:1.

The development in the old-age dependency ratio and the future pension burden depend on demographic characteristics like fertility, mortality and immigration, as well as factors important for labour supply, like education, disability, retirement age, labour force participation rates and part time work (especially for women). One principal objective of the paper is to provide a rather systematic quantitative analysis of the sensitivity for the development in these characteristics. Another principal objective is to estimate effects on the future pension burden of different pension reforms. Based on detailed register data and use of a dynamic micro simulation model, MOSART (c.f. Fredriksen, 1998), it is possible to shed light on the empirical significance of central questions raised in the theoretical literature. Corresponding analyses may be found for countries like Denmark and the Netherlands (c.f.

respectively Velfærdskommissionen, 2004 and Beetsma, Bettendorf and Broer, 2003). In these studies the consequences of ageing related to different assumptions regarding demographic development, labour supply and the pension system are analysed by using general equilibrium models with overlapping generations.

Although a macro approach seems very suitable for analysing the overall effects from different demographic assumptions and labour supply for the old-age dependency ratio and macroeconomic variables, macroeconomic models may lose many potentially important details in analyses of effects for the pension burden. In many countries (and Norway is a good example) the pension system is rather complicated including non-linearities regarding the accumulation of pension entitlements. A micro simulation model including demographic characteristics, labour supply and an accurate description of the pension system therefore seems to be the most appropriate tool in order to obtain accurate estimates of the direct effects on the future pension burden. This kind of model seems even more relevant when analysing the direct effects of pension reforms on individual benefits and government expenditures. Possible distributional effects connected to shifts in the pension system may also be included in a consistent way. Macroeconomic effects, including general equilibrium adjustments, of pension reforms are estimated in Fredriksen, Heide, Holmøy and Solli (2005), where the results from MOSART model are incorporated into a general equilibrium model.

Fertility, mortality and migration are the three components that shape the age structure, and it is of interest to analyse how the future pension burden may be influenced by different assumptions about the further development in the next decades. In Norway there has been a significant growth in the average life expectancy since the National Insurance system was introduced in 1967, and this increase is expected to continue in the future. Although fertility has decreased, it is still relatively high in Norway compared to most other Western countries. In recent decades migration has become a more important factor for population development in Norway, but migration is highly regulated by the authorities.

The main components affecting labour supply consist of participation rates and part-time work (especially for women) and the ages when respectively entering the labour force from education and when retiring. Compared to 1967, the expected retirement age has decreased from about 66-67 years to the current level of 59. This development is mainly caused by an increase in the number of disability pensioners, but a reduction in the formal retirement age in 1973 and early retirement arrangements are also of importance. Although there has been a significant increase in female

participation rates the last decades, women have not reached the male participation level, especially not among those over 50. Many women also work part time and thus represent a potential for further increase in supply of labour. The number of years spent in the educational system may also have effects on the aggregate supply of labour.

Analyses with a microsimulation model like MOSART seems to have been very beneficial to shed light on the effects from different elements of the pension system and different reforms discussed by the recent Norwegian Pension Commission (NOU 2004:1). One of the suggestions outlined in a preliminary report (Norwegian Pension Commission, 2002) was to stop the building up of new entitlements for supplementary pensions. The National Insurance Scheme would then move towards a minimum pension system. An alternative way to reduce future pension expenditures may be to index pension entitlements less than wage growth, also moving towards a minimum pension system in the long run. A more modest shift may be to index entitlements according to wage growth, but letting pensions after retirement only grow according to consumer prices.

Another direction in accordance with the main suggestion from the Commission in its final report is to alter the pension system towards a more actuarial system. The main shifts compared with the existing system are higher proportionality between pension entitlements and former labour income and by connecting the yearly pension benefits dependent to retirement age and life expectancy (smaller pensions if you retire early or life expectancy increases). These elements of a reform may also stimulate labour supply by higher retirement age and increased labour supply among people in the working age. But as pointed out by Gruber and Wise (2002) and Lindbeck and Persson (2003) a shift to a more actuarial system may have distributional effects between different groups of the population.

A brief presentation of the MOSART model, the main assumptions regarding demographics and supply of labour, as well as projections of the labour force, the number of pensioners and the expenditures in the National Insurance System towards 2080, are presented and discussed in Section 2. The effects of different assumptions regarding demographic development and labour supply are discussed in Section 3. Some consequences of a shift towards a minimum pension system are discussed in Section 4, while the effects on labour supply and the pension burden and some distributional effects are discussed in Section 5. Section 6 concludes.

2. The MOSART model and projections of pension expenditures

Tax and benefit rules are often detailed and complicated. Different parts of the population may face different parts of the rules, and there may be substantial problems of aggregation in calculating the total effect on government budgets of changes in taxes or benefits. To meet these problems use of micro simulation models advocated among others Orcutt, Merz and Quinke (1986) has been more and more common in the last decades to support the governments with analyses regarding the effects of different social and financial policies. The basic idea in micro simulation modelling is to represent a socio-economic system by a sample of decision units, e.g. persons, and then model the behaviour of these primary units. Contrary to what is possible in a macroeconomic approach, the detailed and complicated tax and benefit rules may be exactly reproduced. Aggregated numbers are obtained by multiplying the variable of interest for each unit with its sample weight and add across the sample.

When analysing the National Insurance System in Norway, information about the heterogeneity of the population is important because the building up of pension entitlements depends on former labour incomes in a non-linear way (c.f. the outline of the pension system in Section 4). The National Insurance System in Norway is a pay-as-you-system, and the pension burden is also highly dependent on the development of the population by age and the size of the labour force.

From a representative sample of the population in a base year the MOSART model simulates the further life course for each person in this initial population. The life course is simulated by possible transitions from one state to another decided by transition probabilities depending on each person's characteristics. Each of these transition probabilities is estimated from observed transitions in a recent period. Events included in the simulation are migration, deaths, births, marriages, divorces, educational activities, retirements and labour force participation. Public pension benefits are calculated from labour market earnings and other characteristics included in the simulation. Old age pensions, disability pensions, survival pensions and early retirement pensions are included in the model.

The analyses in this paper are based on a representative sample from 1993 that is mainly calibrated to the situation in 2001 (c.f. Table 1). The demographic assumptions are based on Statistics Norway's demographic projections from December 2002. A total fertility rate of 1.8 and a net immigration of 13 000 persons each year imply that the size of the different cohorts stabilizes towards 2050. The aggregate population may however increase as a result of a further increase in life expectancy at birth of about 7-8 years in the same period, and a further increase towards 2100. The assumptions about probabilities for entering disability are based on the observations from 2001 that represent an average for

the fluctuating probabilities during the 1990s. For early retirement schemes there has also been a growing probability for those entitled to enter these schemes during the 1990s, and the projections are based on the observed level from 2001. This is also the case for assumptions about participation in the labour force and working hours. The necessary information about distribution of incomes between individuals over the life cycle is based on observations from a longer period. When pension entitlements are indexed by wage growth in the projections, the choice of base year for wages, prices and the basic unit in the insurance system is of minor importance. For convenience the level from 2001 is chosen.

Table 1. Main underlying assumptions

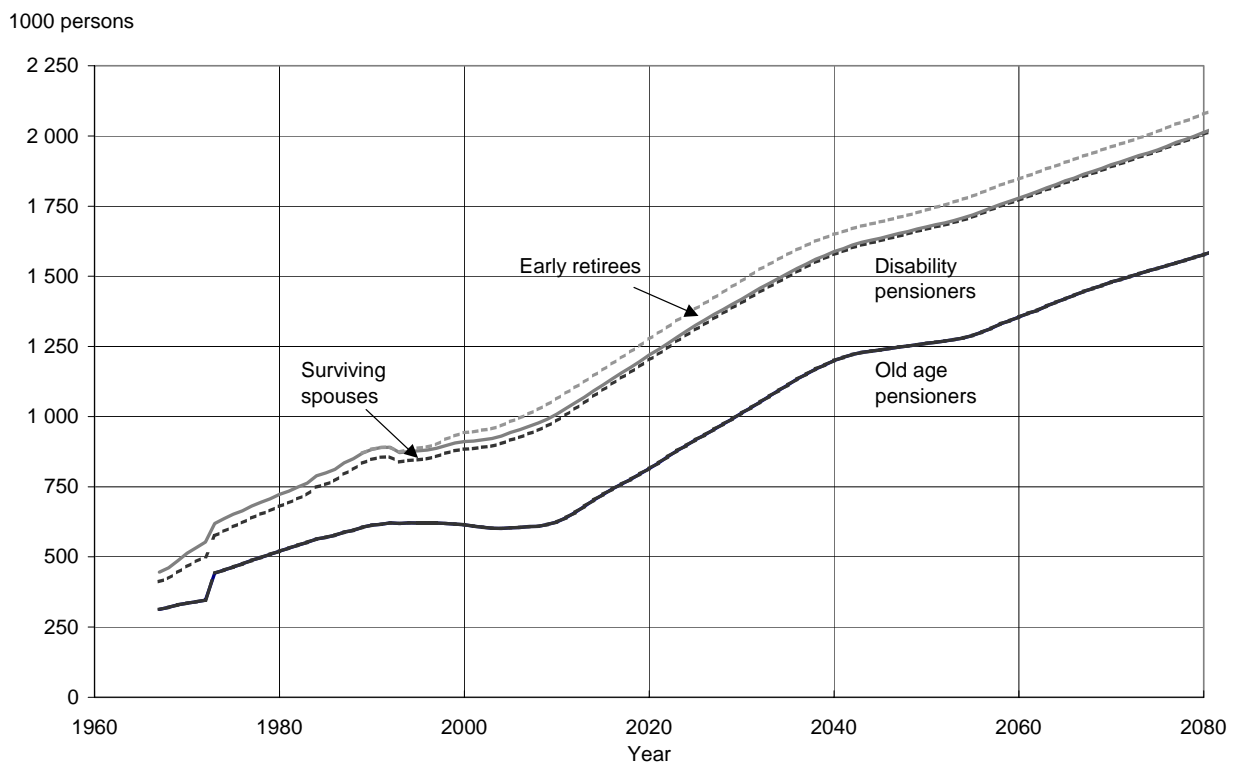
Net immigration	13 000 persons per year
Life expectancy at birth	Increases 7-8 years towards 2050
Total fertility rate	1.8
Propensities to study	As in 2001
Propensities for entering into disability	Observed level from 2001
Propensities for entering early retirement schemes	Observed level from 2001
Formal retirement age	67 years
Labour market participation rates	Observed level from 2001
Distribution of labour incomes during life course	Observed from the period 1967 to 1993
Wages, prices, basic unit	As in 2001

The main implications of these assumptions for the number of pensioners in the next decades are presented in Figure 1. The figure also shows that there has been a substantial growth in the number of pensioners from 1967, when the National Insurance Scheme was introduced, explaining an increasing pension burden the past decades. Specifically the number of disability pensioners has increased, and during the 1990s the use of early retirement schemes became more common. The number of old age pensioners shifted upwards when the formal retirement age was reduced from 70 to 67 years in 1973. These three components are the main reasons why the expected average retirement age has decreased from about 66-67 years in 1967 to about 59 years in 2001.

The increase in the number of old age pensioners since 1967 is also caused by a growth in life expectancy, and from the assumptions outlined in Table 1, this growth is expected to continue. Together with the decrease in the actual average retirement age, the increase in average life expectancy implies that the today's young at average will be pensioners for more than 25 years. As a consequence the number of pensioners is now expected to be 3 to 4 times higher in 2040 than the

observed level from 1967. Assuming continuing growth in life expectancy towards 2100, the number of pensioners becomes almost 5 times higher. Following small birth cohorts from the 1920s and 1930s, after 2010 the larger birth cohorts from 1945 and onwards reach retirement age, also explaining some part of the growth in the number of old age pensioners from 2010 to 2040. We are thus moving from a situation with a small number of elderly due to small birth cohorts to a situation with more even (and more normal) composition of the cohorts.

Figure 1. Number of pensioners

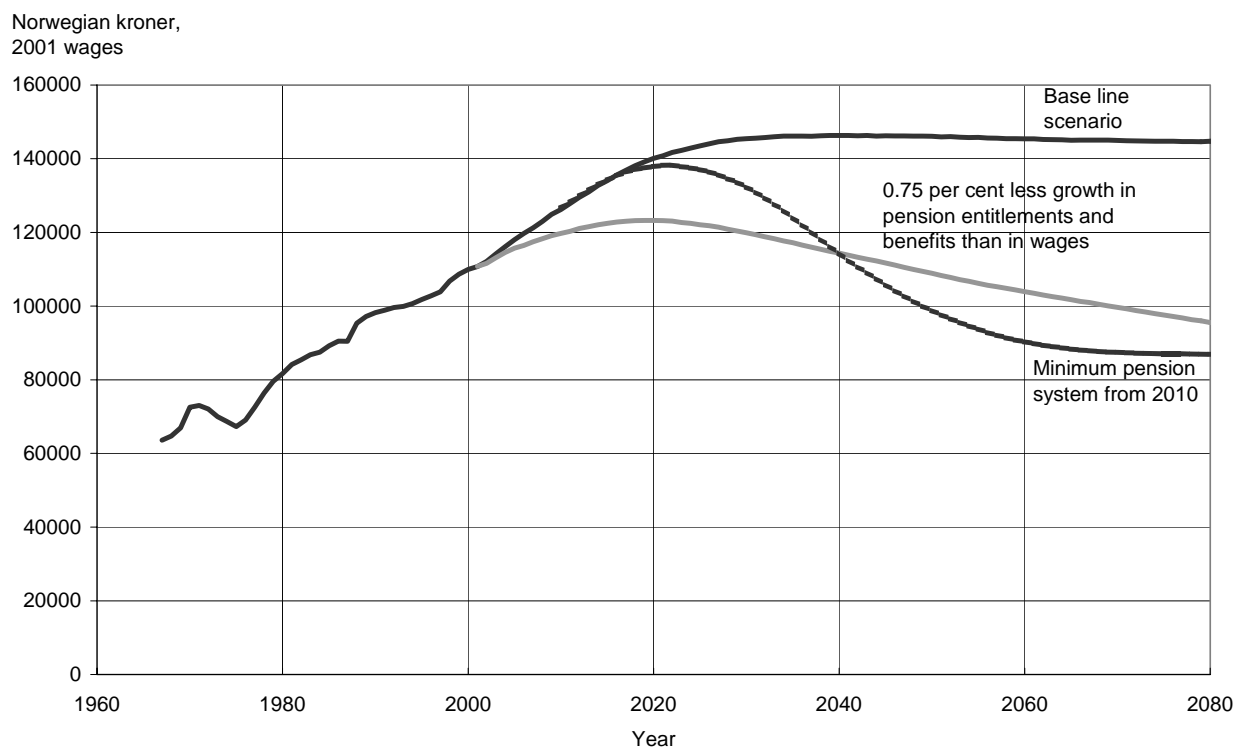


Simultaneously with the growth in the number of pensioners there has also been a significant growth in average pension benefits, as shown in Figure 2. With the present Norwegian pension system (c.f. Section 4) this increase may continue until 2030. The main reason is that only labour incomes obtained after 1967 are taken into account when building up entitlements for supplementary benefits. According to the National Insurance Scheme it is necessary to work for 40 years to obtain maximum benefits, and persons born in 1940 reaching retirement age in 2007 would then be the cohort first able to reach the maximum level. However, the cohort from 1950 is the first one able to include all their potential years in the labour force (17-69 years) in the calculation of their pension entitlements. In addition growing supply of labour among women since 1967, also contributes to increase average

benefits. As a consequence the average replacement ratio grows until 2030. It may then stabilize at more than twice the level from 1967.

An important assumption behind the further growth in the replacement ratio towards 2030 is that the basic unit in the insurance system is indexed by wage growth. During the last 20 years the increase at average has been 0.75 percentage points smaller than average growth in wages per man-year. The consequence of continuing this policy combined with an additional assumption that minimum pensions follow wage growth, is also presented in Figure 2. In this case average pensions may decrease from 2020 to 2060, but as a consequence everyone will become minimum pensioners in the long run. The figure also shows the consequences for average old age benefits of a shift towards a minimum pension system by abolishing the possibility to build up new entitlements for supplementary pensions from 2010. Different reforms of the pension system designed to reduce the average pension benefits from the National Insurance System are further motivated and discussed in Section 4.

Figure 2. Average old age pension benefits



The growth in the number of pensioners together with more generous pension benefits will lead to a substantial increase in the future pension burden. A convenient indicator of the pension burden is the contribution rate defined as

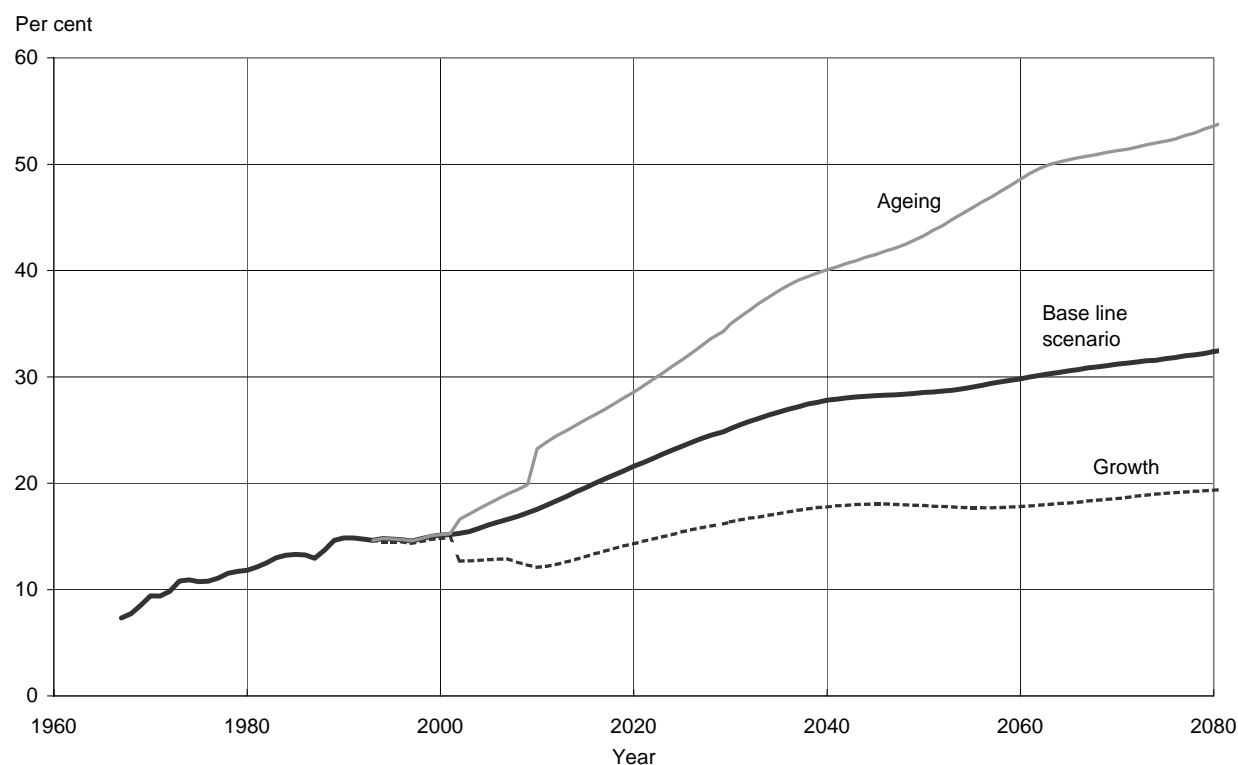
$$C = P / (L + 0.5P).$$

P represents the yearly general pension expenditures in the National Insurance Scheme, and L represents aggregate yearly labour incomes, included compensation for the labour effort among the self-employed. This contribution rate is very close to the concept used in the literature and may be considered as a rough estimate for the tax rate on total labour incomes necessary to finance the pension benefits. We have also taken into account that pension benefits are taxed at about half the tax rate on labour incomes.

The development in the contribution rate from the foundation of the National Insurance System in 1967 to 2001, and further projected towards 2080, is shown in Figure 3. To finance the pension benefits included in the MOSART model the contribution rate has increased from a level of about 7 per cent in 1967 to about 15 per cent in 2001. Based on the assumptions outlined above, the tax burden of financing the sum of old age, disability and survival pension benefits is estimated to increase to 25-30 per cent after 2040. This increase of about 10-15 percentage points is equivalent with the estimated increase in the expenditures in the Insurance Scheme from about 9 per cent of GDP in 2002 to almost 20 per cent in 2050 according to the report from The Pension Commission (NOU 2004:1).

Increasing life expectancy, lower retirement age and higher average pension benefits are the main reasons behind the growth in the contribution rate, and the effects from the different components are further discussed in Section 3 and 4. A higher number of persons in working age and increased female labour supply have contributed to moderate the growth in the financial burden from 1967 to 2001. A drop in fertility below the rate of reproduction has been outweighed by higher immigration in this period, and with the assumptions outlined in Table 1, this may be the case also in the future. For the decades ahead the magnitude of cohorts in working age is rather stable. On the other hand already high, and even higher, life expectancy means a trend towards an increasing share of elderly. It is of course possible that the different assumptions regarding demographic development and supply of labour may move in a more favourable or unfavourable direction than what is assumed for the base line scenario. In the ageing alternative further discussed in Section 3, where several components move in an unfavourable direction, the contribution rate may reach almost 50 per cent in 2060. On the other hand, if several components move in an advantageous direction simultaneously, there may only be a small growth in the contribution rate compared with today's level.

Figure 3. Contribution rate



3. Consequences of alternative assumptions regarding demographic development and supply of labour

For a period of 50 years ahead there is a lot of uncertainty connected to the development in the main demographic components like fertility, mortality, net immigration and labour supply. In projections of the future pension burden it is important to test the sensitivity with regard to different assumptions. This is done by analysing the effects from shifts in the different components corresponding to what has been actually observed in the last 10 to 30 years. A rather detailed survey of the effects from different components on labour supply is presented in Table 2. Effects of less detailed and more simultaneous changes on the contribution rate are presented in Table 3 (below), and for the ageing and growth alternative in Figure 3 (above).

As presented in Table 2 larger population growth as a result of a higher fertility rate and/or higher immigration may reduce the contribution rate. But also new-borns and immigrants get old, and to obtain lasting effects, population growth in per cent has to continue. This means an increasing number of births or net immigration when population increases. In among others a report from the United Nations (2000) it is pointed out that it would be necessary with accelerating immigration to keep the

old-age dependency ratio constant, and such a policy would not be sustainable in the long run. But as stressed by Espenshade, Bouvier and Arthur (1982) higher immigration obviously may be a substitute to lower fertility to prevent population from decreasing. If the relative high fertility in Norway may decrease towards the level observed in other European countries, higher immigration would then be a relevant means to prevent a further increase in the old-age dependency ratio and the pension burden. From Tables 2 and 3 it is evident that higher immigration may increase labour supply and thus ease the pension burden for several decades. Higher immigration has a more immediate effect on labour supply than higher fertility because it naturally takes a couple of decades before new-borns enter the labour force. Although partially reasonable changes in immigration and fertility have some effects on the contribution rate, a contemporaneous change may induce a strengthened simultaneous effect. From Table 3 assumptions of a fertility rate of 1.5 and no immigration may increase the contribution rate about 8 percentage points towards 2060 compared with the base line scenario.

Regarding life expectancy the base line scenario is based on an assumption with an increase of about 7-8 years towards 2050. We have also calculated the effects of a further increase of about 2-3 years and the effects of no further increase in life expectancy from 2001. As most people today live until they become pensioners, the assumptions about life expectancy only has a minor effect on supply of labour, but they are of significant importance for the number of pensioners and the pension burden. From Table 3 the increase in life expectancy towards 2060 increases the pension burden by about 6 percentage points compared to 2001. Based on the growing life expectancy in Norway in the last decades, it seems strange that there will be no further growth. From the assumptions regarding uncertainty for this component of about +/- 2-3 years according to the Population Projections from Statistics Norway, the effect on the pension burden in 2060 is only +/- 2 percentage points.

In Norway women still work less than men. The participation rates are somewhat lower (especially for elderly women), but the main difference is caused by the fact that many women work part time. In alternative calculations we have looked at the effects of women becoming equal with men regarding participation rates, working hours and wage level. From Table 2 it is evident that the effect of equal working hours is about twice as large as the effect of equal participation rates. As increased supply of labour among women also means larger pension entitlements, the effect on the contribution rate of women becoming equal men in the labour market is limited to a reduction of about 2 to 3 percentage points. The effect in the long run is smaller than in the medium run, but as the present pension system favours female working patterns, pension expenditures increase less than labour incomes also in the long run as a consequence of this shift.

Table 2. Effects on the labour force from alternative assumptions about demographic development and labour supply. 1000 persons *

	2001	2020	2060
Base line scenario (level)	2 371	2 580	2 708
Total fertility rate 1.5		- 21	- 491
Total fertility rate 2.1		13	312
No net immigration		141	- 467
Net immigration of 25 000 persons per year		178	591
Further increase in life expectancy of 3-4 years		3	17
Primary school reduced by 1 year		25	31
No early retirement schemes		26	35
Propensity to enter disability as in 1993		113	124
Propensity to enter disability as in 1999		- 31	- 28
Retirement age 62 years		- 21	-16
Propensity to enter disability as in 1993, no early retirement schemes, formal retirement age 70 years		179	211
Propensity to work over 50 as those 3 years younger		129	150
Propensity to work as 3 years younger, propensity for disability as in 1993, no early retirement, ret. age 70		279	316
Participation rates for women equal men		99	96
Total labour supply for women equal men		334	334
Participation rates as in 1993		- 186	- 187

* The effects presented in this table are compared to a base line scenario from 1999 based on that year's population projection, without being important for the effects of the shifts.

Because of the large amount of early retirement caused by disability pensions and early pension schemes, a change in the formal retirement age, only has minor effects on supply of labour (c.f. Table 2) and the pension burden. A partial reduction of the propensity to enter disability to the low level from 1993 has far larger effects on supply of labour, and the effect on the contribution rate is about 4 percentage points. Policy means affecting the retirement age have double effects on the contribution rate by increasing supply of labour and reducing pension expenditures. In Table 2 we have also presented the effect of a postponed retirement age of 3 years for everyone. With assumptions of a simultaneous increase in the formal retirement age to 70 years, abolishment of early retirement schemes and propensities to enter disability as in 1993, the contribution rate may be about 6 percentage points lower in 2060.

If several of the assumptions change simultaneously, the total effect on the contribution rate may be of significant magnitude. In Figure 3 we have presented the effects of an ageing alternative where the changes in some of the underlying assumptions work in an unfavourable direction regarding financing of the pension system, but where the change in each of them is of reasonable magnitude compared to shifts in the past decades. More precisely, in this alternative we have looked at a situation with a total

fertility rate of 1.5, no immigration, extra increase in life expectancy of 2-3 years towards 2050, labour market participation rates from the low level in 1993, propensities to enter into disability from 1999 and a further decrease in retirement age. With these assumptions the contribution rate may reach as high as almost 50 per cent in 2060, about three times as high as today's level. On the other hand it may be possible with a more favourable development than in the base line scenario regarding fertility, immigration, women's supply of labour, the propensity to enter disability and retirement age. If all these components shift by a reasonable magnitude compared to observed shifts, but simultaneously in a favourable direction regarding the pension burden, there may only be small increase in the contribution rate towards 2060 as illustrated in the growth alternative in Figure 3.

Table 3. Effects on the contribution rate of shifts in different assumptions *

	2001	2030	2060
<i>Base line scenario, per cent</i>	15.2	25.2	29.8
<i>Effects, percentage points</i>			
Total fertility rate 1.5		0.8	4.6
No immigration		1.4	2.0
Total fertility rate 1.5, no immigration		2.5	7.8
Further increase in life expectancy about 2-3 years		0.8	2.0
No increase in life expectancy from 2002		- 2.1	- 6.1
Women equal men in the labour market		- 2.7	- 2.4
Formal retirement age 62 years		2.1	2.2
Propensity to enter disability as in 1993		- 3.8	- 3.8
Formal retirement age 70 years, no early retirement schemes, and propensity to enter disability as in 1993		- 5.4	- 5.9

* Except from the shifts in life expectancy the effects presented in this table are compared to a base line scenario from 1999 based on that year's population projection, without being important for the effects of the shifts.

4. Effects of reforms in direction of a minimum pension system

The concern for the growth in the future pension burden has caused a lot of discussion about pension reforms in many countries, and several reforms have already been implemented (cf. Lindbeck and Persson, 2003 for a survey). In Norway a Pension Commission has recently discussed actual reforms. A preliminary report from the Commission was presented in autumn 2002, and the final report was completed in January 2004.

Pension benefits from the National Insurance Scheme (NIS) are based on entitlements each person achieves through his or her working years. NIS has its own measuring unit called the *Basic Pension Unit* (BPU). The BPU is used to calculate pension entitlements and adjust pension benefits according

to inflation and general economic growth. Pension benefits (PB) to old age, disability and survivor pensioners constitute of Basic Pension (BP) and the maximum of a Special Supplement (SS) and a Supplementary Pension (SP).

$$PB = BP + \text{Max} (SS, SP)$$

A pensioner married to another pensioner receives a Basic Pension of 80 per cent of BPU (from May 2003), while single pensioners receive 1 BPU. The Special Supplement for single pensioners was 79.33 per cent of BPU in 2003. The sum of BP and SS is the Minimum Pension Benefit all pensioners are guaranteed.

The Supplementary Pension is based on previous labour market earnings. Each year when the person is in the interval 17 to 69 years old, the labour market earnings are translated into Pension Points (PP) by using the BPU of the year income (Y) was earned:

$$PP = \begin{cases} 0 & \text{If : } Y < \text{BPU} \\ (Y - \text{BPU}) / \text{BPU} & \text{If : } \text{BPU} \leq Y < 6 \text{ BPU} \\ 5 + (Y - 6 \text{ BPU}) / 3 \text{ BPU} & \text{If : } 6 \text{ BPU} \leq Y < 12 \text{ BPU} \\ 7 & \text{If : } Y \geq 12 \text{ BPU} \end{cases}$$

The main rule for calculating Pension Points is that labour market earnings exceeding BPU are divided by BPU. Labour market earnings exceeding 6 BPU are divided by 3 BPU, and earnings exceeding 12 BPU are neglected. The Final Pension Point (FPP) is calculated as the average of the 20 largest positive PPs, while Pension Point Years (PPY) is the number of years with labour market earnings above BPU. The Supplementary Pension is calculated when using the BPU at the time pension benefit is received:

$$SP = \text{SPR} \times \text{Min} (PPY, 40) / 40 \times \text{BPU} \times \text{FPP}$$

SPR represents a marginal *benefit-wage ratio*, and its present value is 42 per cent. The second term, $PPY / 40$, represents the *earning time percentage*. The last two terms, $\text{BPU} \times \text{FPP}$, represent an *income base*, and for incomes above 1 BPU and below 6 BPU it is equal to the former income as employee indexed by the growth in BPU.

One of the main directions for a pension reform outlined in the preliminary report from the Pension Commission (2002) was to change the public pension system towards an equal minimum pension for everybody. One way to implement such a system is to stop the building up of new entitlements for supplementary pensions from a given year, 2010. A minimum pension system is reached after some decades when all present persons with existing entitlements for supplementary pensions either are dead or the current entitlements are too small to exceed the special supplement. As presented in Figure 4, this will cause a drop in the contribution rate compared with the base line scenario of about 10 percentage points in 2060, and the contribution rate may stabilize at about 5 to 8 percentage points higher than the level in 2000. From Figure 5 the share of minimum pensioners will increase, and the reform is completely implemented by approximately 2080.

Figure 4. Effects on the contribution rate by reducing / removing supplementary pension entitlements

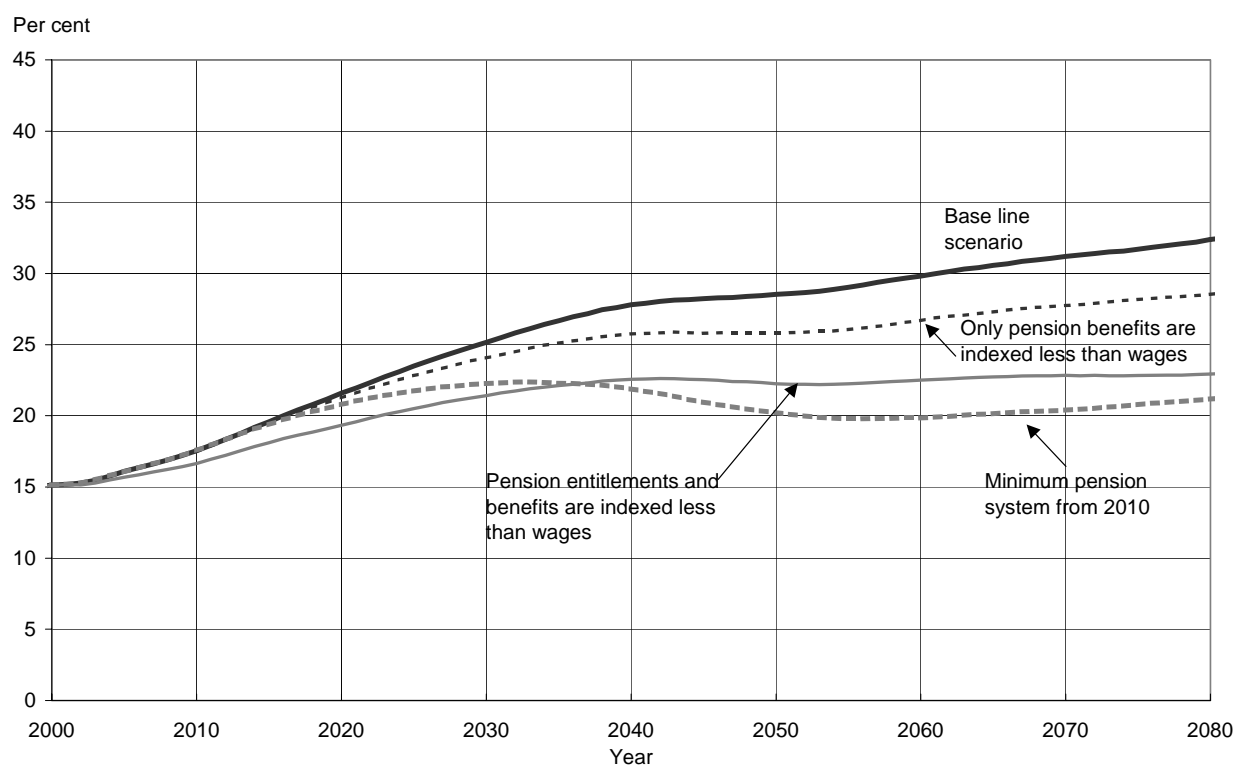
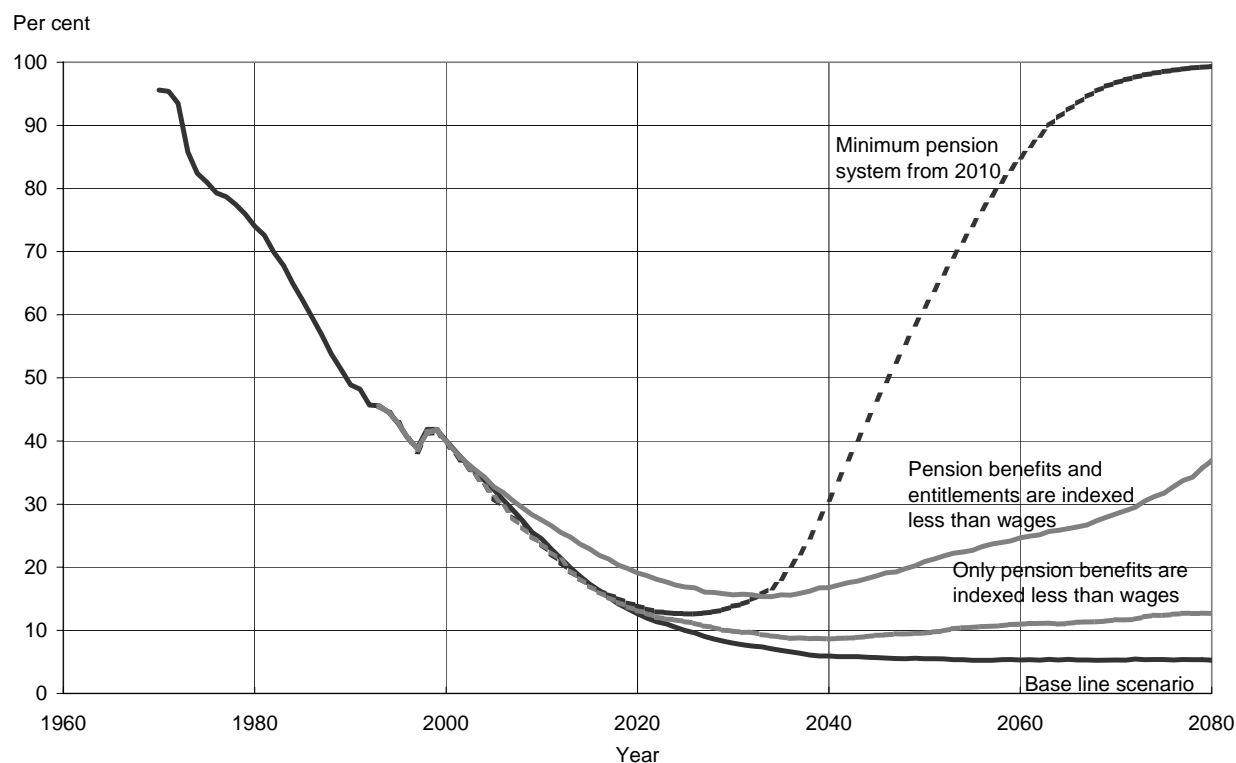
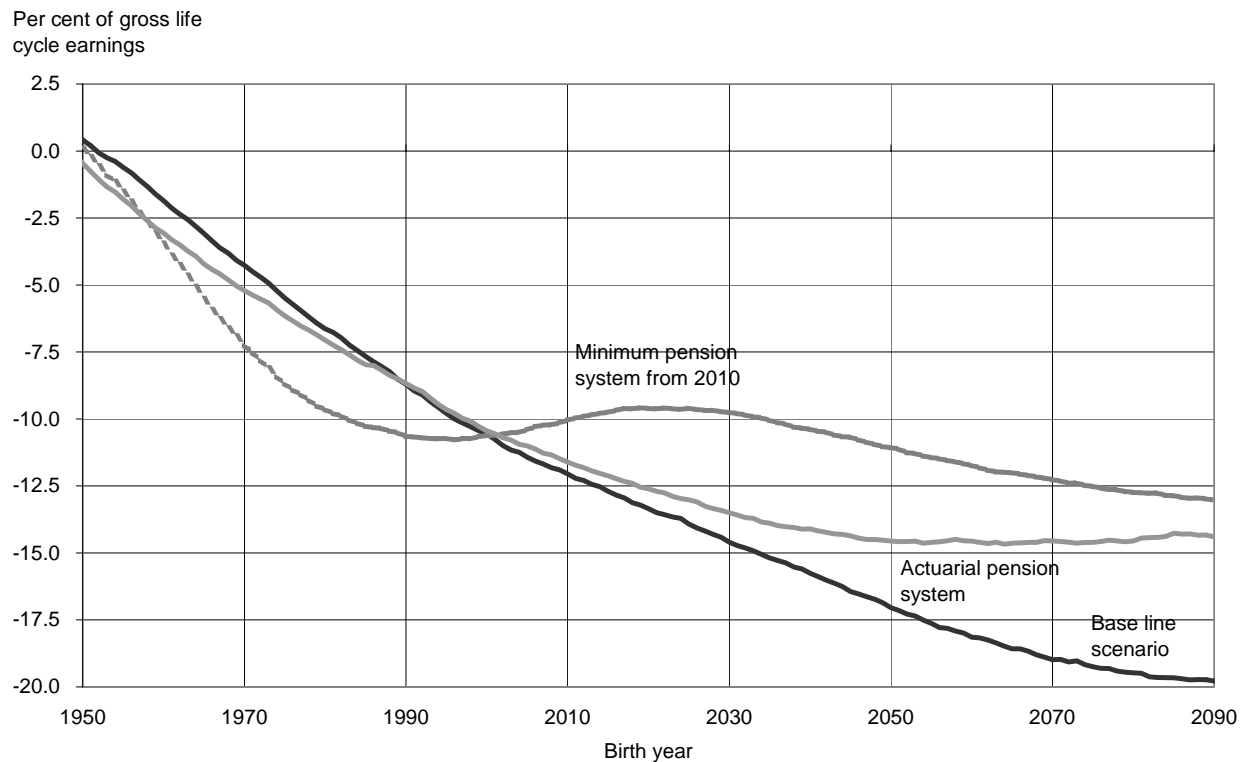


Figure 5. Effects on the share of minimum pensioners in the National Insurance Scheme by reducing / removing supplementary pension entitlements



With this proposal, future pensioners wishing to maintain their supplementary pensions have to secure their pension entitlements themselves. Pre-funding in private insurance companies may then be a natural alternative. As pointed out by among others Miles and Timmermann (1999), Brunner (1996) and Feldstein and Liebman (2002), a shift from a pay as you go system in direction of more funding affects income distribution between generations. This is illustrated in Figure 6 by showing the effects on the present value of net pension payments for different cohorts when moving towards a public minimum pension system. Net pension wealth is calculated as the present value at age 16 of all contributions to and benefits from the pension system when assuming a pay as you go system and a 2.5 per cent net interest rate (the difference between nominal interest rate and wage growth).

Figure 6. Net pension wealth for different cohorts under different pension systems



In the base line scenario, reflecting the present pay-as-you-go system, the increasing pension burden causes net pension wealth to fall for every subsequent cohort towards 2090. Only cohorts born before 1950 seem to have benefited from the system. But the negative figures are partly caused by the assumption of a rather high net interest line with the assumptions used by the Pension Commission, giving small weights to future benefits compared with more instant contributions. As cohorts born before 1950 are more than 60 years old in 2010, they are only modestly affected by the reform. Cohorts born between 1950 and 1995 may loose. As the implementation of the reform lasts for more than 60 years, and the expenditures for supplementary pensions benefits in the present system are significant smaller than the expenditures for minimum pensions, no birth cohorts in present value loose more than three percentage points of their gross life earnings. And they are not much worse off than the cohorts born after 2000 gaining from the reform.

The connection between labour incomes and benefits as pensioner has been weakened since the National Insurance Scheme was introduced in 1967. This is caused by a strengthening of the minimum pension benefit in combination with a lower indexation than wages for benefits exceeding that level. In addition the payment of supplementary pensions was explicitly tightened in 1992 together with smaller possibilities to obtain pension entitlements from high labour incomes.

If the policy with lower indexation of supplementary pension benefits compared with wages continues, this is also a movement towards a minimum pension system. The effects on the contribution rate of a policy with moderately lower indexation of the basic unit compared to wage growth of about 0.75 percentage points a year (but keeping up the real value of minimum pensions compared to wages), are also shown in Figure 4. This policy may also be sufficient to prevent the pension burden to increase much compared with the today's level and have rather equal effects on the contribution rate as a shift to a minimum pension system from 2010. Even with a moderate growth in real wages of about 1.5 per cent each year, this still may give a real growth in pension benefits of 0.75 per cent.

A lower indexation than wage growth means a decrease in future pension benefits compared with the wage level. And if minimum pension benefits are indexed according to wages, everyone will become minimum pensioners in the long run also in this alternative. However, as shown in Figure 5 the process towards a minimum pension system takes more time in this case than a direct shift towards a minimum pension system from 2010. With a minimum pension system all individual payments to the system completely may be considered as a tax. A more modest alternative (also considered by the Commission) is to only index pension benefits after retirement less than wages. As shown in Figure 4 such a reform may reduce the contribution rate about 5 percentage points in 2060 compared with the base line scenario. The share of minimum pensioners as a consequence of this reform is of course only modestly higher than in the base line scenario as this share mainly is dependent on the regulation of entitlements before retirement age.

5. Effects of reforms towards a more actuarial pension system

An alternative direction for reforms according to the main suggestions from the majority of the Commission (NOU 2004:1) is to alter the pension system towards higher proportionality between pension entitlements and earnings. Another important element in the proposed reform is to make the yearly pension benefits dependent on retirement age and life expectancy. If a person retires early, or his life expectancy increases, the pension entitlements are distributed over a higher number of years as pensioner, resulting in smaller pensions per year. In the literature (c.f. Lindbeck and Persson, 2003) such a reform is characterized as a movement towards actuarial fairness. Increased supply of labour caused by higher actual retirement age and a reduction of the tax element in the pension premium are probably positive effects of a shift in this direction. These effects are also discussed in the literature, among others in a paper by Zhang (2003). A change from today's pay as you go system to funding may be a possible (but not a necessary) element in such a reform.

It is of course not simple to give precise estimates of the two positive effects on supply of labour. As presented in several analyses (cf. Gruber and Wise, 1999 and 2004 for international comparisons) the loss in total pension payments by postponing the retirement age may be important. They also find that the formal age for (early) retirement is quite decisive. In Norway Hernæs et al. (2000) and Røed and Haugen (2002) find that the present Norwegian early retirement scheme favours early retirement because there are not any negative consequences for future pension benefits. A tightening of these schemes is then expected to have a positive effect on the participation rates for elderly workers.

To make a simple estimate on how the retirement age might be affected by a shift towards a more actuarial pension system, our point of departure has been the average of the observed participation rates among men in the age 60-66 years from the beginning of the 1980s and the low participation rates observed in 1999 among those in the corresponding group that may enter an early retirement scheme without losing rights for pension. By further corrections because only 60 per cent of the labour force are included in the early retirement schemes, the average retirement age is estimated to increase by 0.6 years in 2015. With an actuarial system the average retirement age is expected to increase when life expectancy increases. Average retirement age is thus estimated to increase by 1,6 years in 2030 and 2,6 years in 2050. As shown in Table 4, a reform making the yearly pension benefit dependent on the retirement age, may reduce the number of old age pensioners included early retirements with almost 200 000 persons in 2050 and the total pension expenditures with more than 25 billions Norwegian kroner compared with the present system.

Table 4. Projections of the number of old age pensioners (early retirements included) and corresponding pension expenditures measured in 2001 amounts in the present and an actuarial pension system

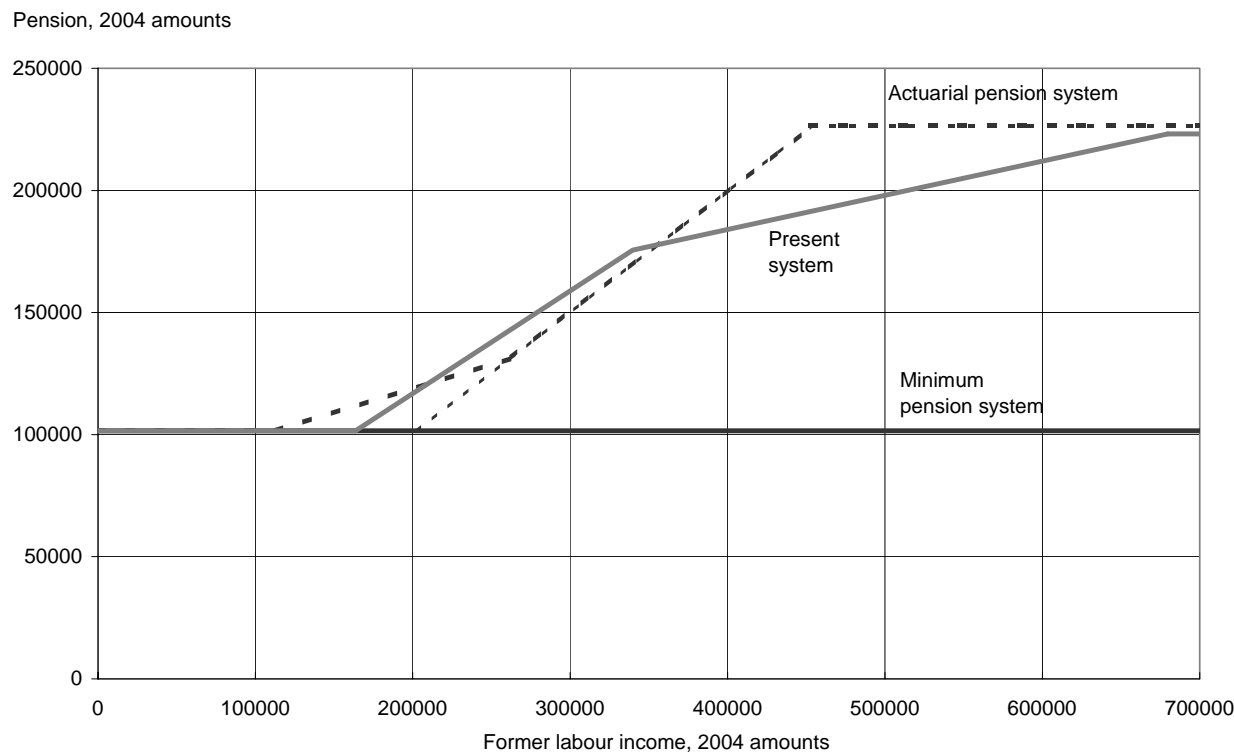
	Number of old age pensioners 1000 persons		Pension expenditures Bill. NOK	
	Present	Actuarial	Present	Actuarial
2000	642		71.8	
2010	678	679	86.6	85.8
2020	871	784	122.6	108.9
2030	1075	941	156.8	134.2
2040	1261	1077	184.7	156.8
2050	1321	1127	193.2	167.6

A movement towards a more actuarial pension system implies a smaller effective tax rate (c.f. among others Lindbeck and Persson, 2003). By keeping average benefits and tax rates unchanged this means a positive substitution effect on labour supply without any counteracting income effect. Because the connection between pension contributions and benefits is not evident for an average employed with

the present system, and probably not will be quite evident in the new system, it is also difficult to obtain a precise estimate of how much supply of labour among people that have not reached retirement age will be affected. With assumption of a net interest rate about 2,5 per cent, a rough estimate of the effect on supply of man-hours of an actuarial reform is about 4 per cent.

In the actuarial pension system (compared with the present in Figure 7) the pension entitlements are calculated as 1.25 per cent of total labour incomes during the life cycle up to a ceiling for annual incomes of 8 times the Basic Pension Unit (BPU). A guaranty pension at the same level as the present minimum pension is introduced and financed by ordinary income taxes. But as the guaranty entitlements are means-tested against the level of income dependent entitlements¹, the total expenditures financed directly by taxes will become rather low. These aspects of the actuarial pension system compared with the present are illustrated in Figure 7.

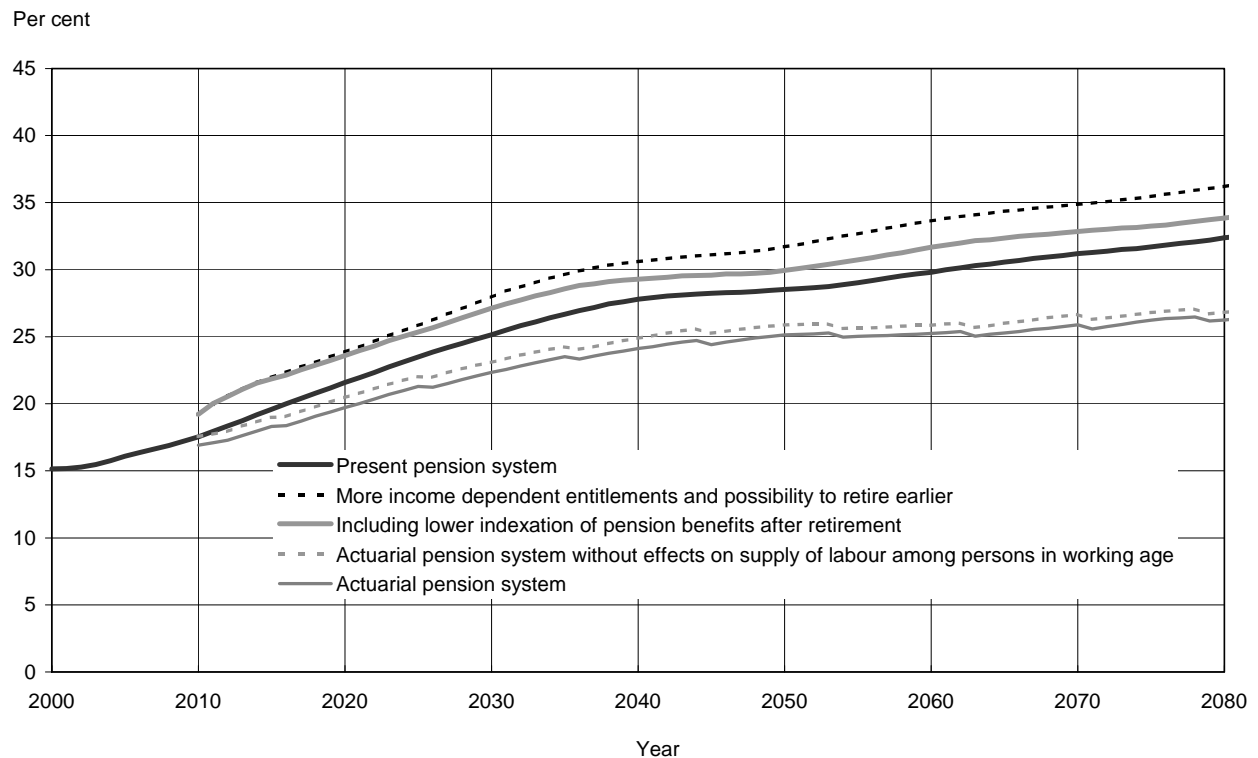
Figure 7. The connection between labour incomes and pension entitlements in the present and an actuarial pension system¹



¹ For a single person with stable income for 40 years.

¹ This is a simplified description compared with the actual proposal outlined in Figure 7 where the guaranty pension is reduced by 60 per cent of the increase in income dependent entitlement in an interval for persons with low incomes.

Figure 8. Effects on the contribution rate caused by a shift to an actuarial system, decomposition in different elements



The effects on the contribution rate of a movement towards a more actuarial pay-as-you-go system affecting retirement age and supply of labour before retirement according to what is outlined above, is analysed with the MOSART-model and presented in Figure 8. In addition to the actuarial elements mentioned above, the annual pensions after retirement are assumed to be indexed by 0.75 percentage points less than wages to reduce the growth in future pension expenditures. The suggested reform means a drop in the contribution rate of about 5 percentage points in 2060. This corresponds to only 1/3 of the increase in the contribution rate from 15 per cent in 2000 to 30 per cent in 2060 with the present system.

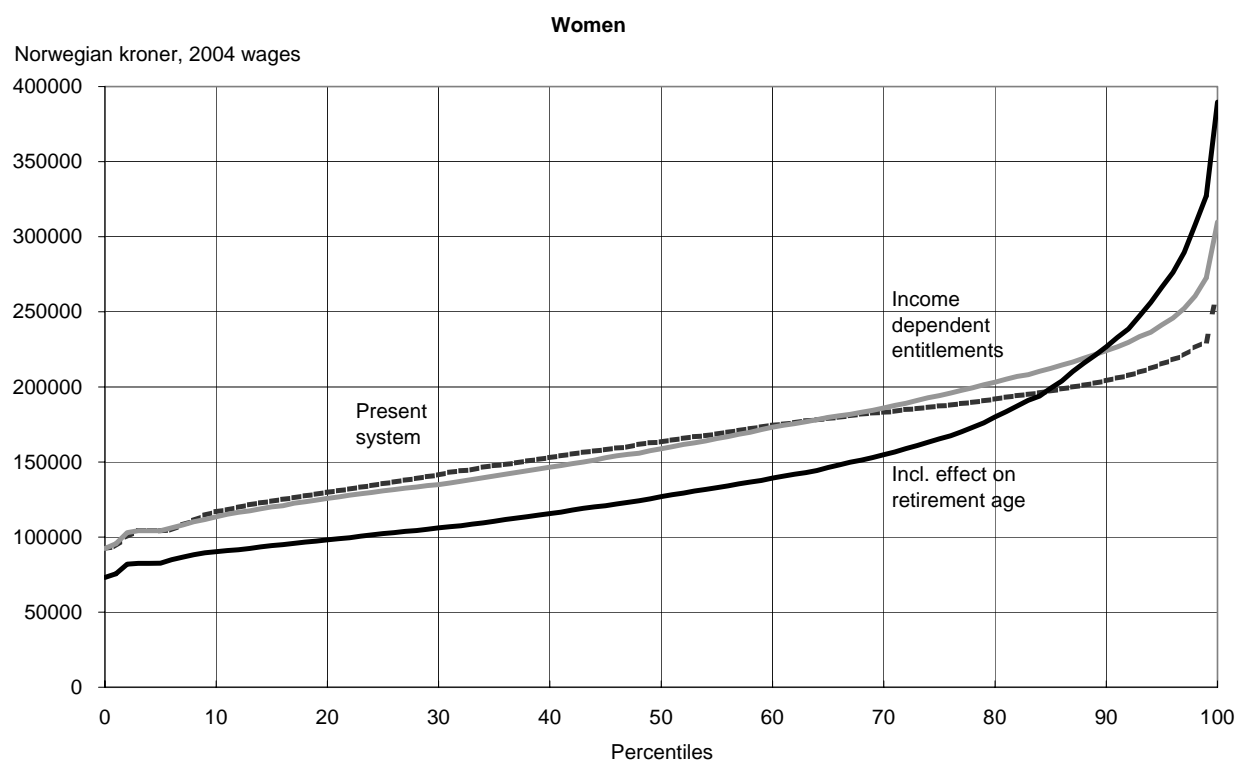
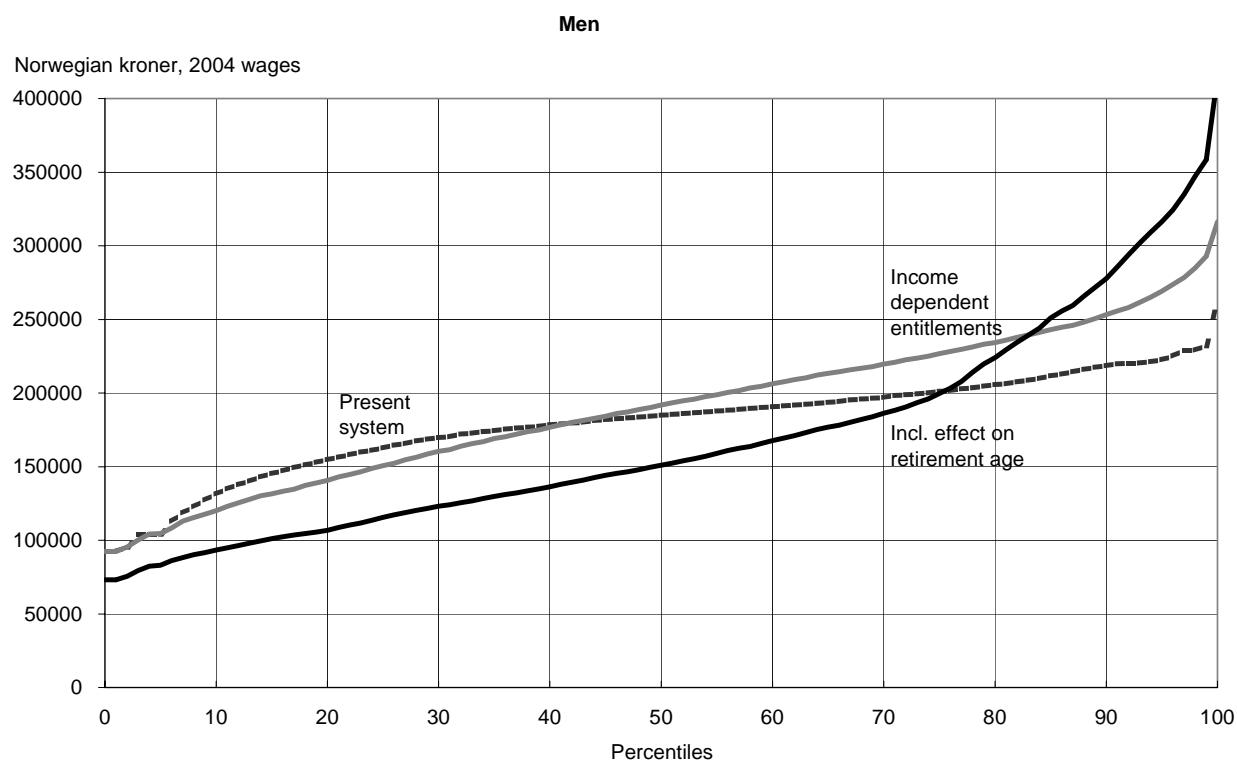
The positive effect on the present value of net pension wealth for different cohorts of a shift to an actuarial (but still pay-as-you-go) pension system is illustrated in Figure 6. A movement to an actuarial pay-as-you-go system may increase the net pension wealth for future generations without having negative effects in a transition period as the growth in expenses is reduced simultaneously with an increase in labour supply. A further shift to a funded system would obviously be even more beneficial for future generations, but more costly for the generation working in the transition period. As pointed out by Lindbeck and Persson (2003) the degree of actuarial fairness and the degree of funding may be

considered as two separate dimensions. Like the shift towards a public minimum pension system with private funding of supplementary pensions, a movement from an actuarial pay-as-you-go system to an actuarial funded would introduce a double burden on the labour force in the transition period.

Figure 8 also shows a decomposition of the effects on the contribution rate according to the most important elements by use of the MOSART-model. Two elements in the proposed system partially increase pension expenditures. The most important is caused by the increased connection between pension entitlements and former labour incomes in the interval between 6 and 8 BPU, and labour incomes for more than 40 years also give higher entitlements. A more general possibility to retire early, at age 62, in the new system works in the same direction and is estimated to have an immediate partial effect of 2 percentage points because 40 per cent of the labour force is not included in the early retirement schemes and will reduce their retirement age when formal age is reduced from 67 to 62. While the partial effect of this element decreases as time goes by, the effect of closer connection between entitlements and former labour incomes increases. In 2060 the total effect of building up entitlements and lower general retirement partially is estimated to increase the contribution rate with almost 4 percentage points.

The partial effect from lower indexation of pension benefits than wage growth after retirement is represented by the difference between the upper and the second upper curve. The effect of this element increases as time passes, and is estimated to about 2 percentage points in 2060. The actuarial element reduces yearly pensions for given total entitlements if a person retires early or life expectancy increases. This is the main factor of the reform regarding reduction of the contribution rate. As life expectancy is assumed to increase during the entire period of projection, the effect of this element increases. The pecked course for the two lower curves is caused by a discrete adjustment of the actuarial element for practical reasons as life expectancy at average is assumed to increase by 1 year each 6th - 8th year. The total partial effect of the actuarial element in 2060 is an estimated reduction of the contribution rate of about 6 percentage points. The difference between the two lower curves represents the partial effect of increased supply of man-hours among persons in working age. Although labour supply is estimated to increase as much as 4 per cent as a result of closer connection between contributions to and benefits from the pension system, the partial effect on the contribution rate of this element is only about 1 percentage point.

Figure 9. Average old age pension for different percentiles of old age pensioners



Even with maintaining a pay-as-you-go system, a shift to a higher degree of proportionality with former labour incomes has distributional effects. Based on the main suggestion for a change of the pension system towards actuarial fairness from the Pension Commission (NOU 2004:1), the MOSART model is used to calculate the distributional effects among pensioners when the new system is almost completely implemented (about 2050). This is illustrated in Figure 9 for men and women respectively. The figure illustrates the distributional effects of the elements in the reform causing higher proportionality between pension benefits and former labour incomes over the entire life cycle up to labour incomes 8 times the Basic Pension Unit (BPU).

As the connection between pension benefits and labour incomes in the present pension system is only modest for incomes exceeding 6 BPU, as outlined in Section 4 and illustrated in Figure 7, such a shift will obviously favour those with higher incomes. When average and minimum old age pensions are kept at the same level as in today's system, the benefits for persons with pensions slightly exceeding minimum pension have to decrease. Only taking the components of income dependent entitlements into account, the two curves for men intersect at about 180 thousand Norwegian kroner corresponding to about 40 per cent of the male pensioners. When also the actuarial effects regarding lower yearly pensions if you retire early is taken into account, the effects on income distribution are far more evident. This is mainly caused by a higher propensity to retire early among persons with low incomes and vice versa, and differences in pension entitlements are strongly strengthened when we look at annual pensions in a system with actuarial elements.

Because of more modest incomes among women than among men (partly caused by a greater extent of part-time work), a shift to an actuarial system will be more unfavourable for women. Also for women the curve for income dependent entitlements in Figure 9 intersects with the present system at about 180 thousand Norwegian kroner, and this pension level corresponds to more than the 60 percentile of female pensioners. But the loss in pension entitlements compared with the present system for women with middle incomes is only modest. The difference is larger for actual pensions taken into account that also women with higher labour incomes tend to retire later. As is evident from this discussion, there may be a conflict between concerns for efficiency and income distribution when reforming the pension system.

6. Conclusions

The ageing of the Norwegian population in the next decades together with more generous pension benefits will lead to a substantial increase in the future pension burden if the present pension system is maintained. Norway is in an advantageous position compared to most other Western countries as fertility is relatively high, and lower fertility than the reproduction level is compensated by net immigration. But of political and practical reasons there are probably limitations for the level of immigration to reduce the future pension burden. Increased supply of labour, especially among women, is beneficial, but as this also means higher pension entitlements in the long run, the effect does not seem to be large. The most effective remedies regarding demographics or supply of labour seem to be of the kind contributing to later retirement affecting both pension expenditures and the number of persons in the labour force. But of political reasons it may be quite difficult to reverse the reduction in retirement age that has taken place during the last decades. If several components regarding demographics and labour supply shifted in the same direction related to the pension burden, it could have a significant joint effect. However, a substantial increase in the pension burden with the present pension system seems to be unavoidable, and the scope for political remedies to affect demographic development and labour supply may be narrow.

Reforms of the pension system then seem to be necessary to reduce the future financial burden. But it is necessary with a substantial tightening of the system to prevent the burden from increasing. Even with a rather comprehensive shift to a public financed minimum pension system, the expenses for old age, disability and survivor pensions may increase to 20 per cent of the total labour incomes in 2060 versus 15 per cent today. With a minimum pension system each person has to take responsibility for his or hers supplementary pensions, and today's employees are hurt by a double burden in the transition period.

The recent Norwegian Pension Commission has proposed a more moderate tightening, also stimulating labour supply among those at work and exposing retirement age. This may be obtained by a shift towards a more actuarial system increasing the connection between pension entitlements and former labour incomes and by reducing the yearly pensions if a person retires early. In the proposal the pension system is also tightened by decreasing the yearly pensions in accordance with further growth in life expectancy and by indexing pension benefits after retirement less than the growth in wages. The analysis shows that the actuarial element reducing yearly pension benefits as a consequence of early retirement and higher life expectancy is the most important one in reducing the future pension burden. Indexation of pension benefits less than wages also has a tightening effect. Making a closer connection

between pension entitlements and former labour incomes may have positive effects on labour supply. The magnitude of the effect is, however, uncertain, and the effect on the contribution rate seems to be rather small. As elements of redistribution of incomes are included in the present pension system, a closer connection to former labour incomes is in favour of persons with higher incomes. There may thus be a conflict between the concern for income distribution and a movement towards a more actuarial system making a closer connection between pension entitlements and former labour incomes in order to stimulate supply of labour.

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